

## CLAIMS

1. A moving picture encoding method capable of using a reference frame number in multi-frame motion prediction and variable-length code reference frame information corresponding to the number, said method comprising the steps of:

5        acquiring a reference frequency of the reference frame;

         with the reference frequency, acquiring reference frame identification information so that a ratio of a reference frame index code occupying a bit stream is reduced; and

         multiplexing the reference frame identification information together with  
10    encoded moving picture data.

2. The moving picture encoding method according to Claim 1, wherein the step of acquiring the reference frequency comprises a step of calculating the reference frequency.

3. The moving picture encoding method according to Claim 2, wherein the step of acquiring the reference frame identification information comprises a step of assigning a relatively shorter code to the reference frame index code of a reference frame referred with relatively high frequency and assigning a  
5    relatively longer code to the reference frame index code of a reference frame referred with relatively low frequency, thereby acquiring the reference frame identification information.

4. The moving picture encoding method according to Claim 2 or 3,

wherein the step of calculating the reference frequency comprises a step of acquiring a reference frame for each block from a prediction error and a weighted sum of motion vectors and of calculating a reference frequency of the  
5 acquired reference frame.

5. The moving picture encoding method according to Claim 2, wherein the reference frequency is calculated as to all of the reference frame.

6. The moving picture encoding method according to Claim 2, wherein the reference frequency is calculated as to a part of the reference frame.

7. The moving picture encoding method according to Claim 1, wherein the step of acquiring the reference frequency comprises a step of calculating a frame similarity and of then estimating the reference frequency of the reference frame.

8. The moving picture encoding method according to Claim 7, wherein the step of acquiring the reference frame identification information comprises a step of assigning, based on the reference frequency, a relatively shorter code to the reference frame index code of a reference frame referred with relatively  
5 high frequency and assigning a relatively longer code to the reference frame index code of a reference frame referred with relatively low frequency, thereby acquiring the reference frame identification information.

9. The moving picture encoding method according to Claim 7 or 8, wherein the step of estimating the reference frequency comprises the steps of:

extracting an orthogonal transformation coefficient from a picture frame to  
calculate the frame similarity; and estimating the reference frequency from the  
5 frame similarity.

10. The moving picture encoding method according to Claim 7 further  
comprising the steps of:

detecting a reference frame of which the frame similarity is excessively  
low; and

5 regarding the detected reference frame as a non-reference frame.

11. The moving picture encoding method according to Claim 7, wherein  
the reference frequency is estimated as to all of the reference frame.

12. The moving picture encoding method according to Claim 7, wherein  
the reference frequency is estimated as to a part of the reference frame.

13. A moving picture encoding apparatus capable of using a reference  
frame number in multi-frame motion prediction and variable-length code  
reference frame information corresponding to the number, said apparatus  
comprising:

5 reference frame identification information calculation means for  
calculating a reference frequency of the reference frame and for, with the  
reference frequency, acquiring reference frame identification information so that  
a ratio of a reference frame index code occupying a bit stream is reduced; and  
multiplexing means for multiplexing the reference frame identification  
10 information together with encoded moving picture data.

14. The moving picture encoding apparatus according to Claim 13,  
wherein the reference frame identification information calculation means  
comprises means for, based on the reference frequency, assigning a relatively  
shorter code to the reference frame index code of a reference frame referred  
5 with relatively high frequency and assigning a relatively longer code to the  
reference frame index code of a reference frame referred with relatively low  
frequency, thereby acquiring the reference frame identification information.

15. The moving picture encoding apparatus according to Claim 13 or 14,  
wherein in calculation of the reference frequency, a reference frame for each  
block is acquired from a prediction error and a weighted sum of motion vectors  
and the reference frequency is then calculated.

16. The moving picture encoding apparatus according to Claim 13,  
wherein in calculation of the reference frequency, the reference frequency is  
calculated as to all of the reference frame.

17. The moving picture encoding apparatus according to Claim 13,  
wherein in calculation of the reference frequency, the reference frequency is  
calculated as to a part of the reference frame.

18. A moving picture encoding apparatus capable of using a reference  
frame number in multi-frame motion prediction and variable-length code  
reference frame information corresponding to the number, said apparatus  
comprising:

5 reference frame identification information calculation means for

calculating a frame similarity to estimate a reference frequency of the reference frame and for acquiring, with the reference frequency, reference frame identification information so that a ratio of a reference frame index code occupying a bit stream is reduced; and

10           multiplexing means for multiplexing the reference frame identification information together with encoded moving picture data.

19. The moving picture encoding apparatus according to Claim 18, wherein the reference frame identification calculation means comprises means for, based on the reference frequency, assigning a relatively shorter code to reference frame index code of a reference frame referred with relatively high  
5 frequency and assigning a relatively longer code to the reference frame index code of a reference frame referred with relatively low frequency, thereby acquiring the reference frame identification information.

20. The moving picture encoding apparatus according to Claim 18, wherein in estimation of the reference frequency, an orthogonal transformation coefficient is extracted from a picture frame to calculate a frame similarity, and the reference frequency is then estimated from the frame similarity.

21. The moving picture encoding apparatus according to Claim 18, wherein in estimation of the reference frequency, calculation is performed while a reference frame of which the frame similarity is excessively low is regarded as a non-reference frame.

22. The moving picture encoding apparatus according to Claim 18,

wherein in estimation of the reference frequency, the reference frequency is estimated as to all of the reference frame.

23. The moving picture encoding apparatus according to Claim 18, wherein in estimation of the reference frequency, the reference frequency is estimated as to a part of the reference frame.

24. A program causing a computer to execute processes, said computer executing moving picture encoding capable of using a reference frame number in multi-frame motion prediction and variable-length code reference frame information corresponding to the number, said processes comprising:

5           a process for acquiring a reference frequency of the reference frame;  
          a process for, with the reference frequency, acquiring reference frame identification information so that a ratio of a reference frame index code occupying a bit stream is reduced; and

10           a process for multiplexing the reference frame identification information together with encoded moving picture data.

25. A computer-readable storage medium stored with a program causing a computer to execute processes, said computer executing moving picture encoding capable of using a reference frame number in multi-frame motion prediction and variable-length code reference frame information corresponding

5   to the number, said processes comprising:

          a process for acquiring a reference frequency of the reference frame;  
          a process for, with the reference frequency, acquiring reference frame identification information so that a ratio of a reference frame index code

occupying a bit stream is reduced; and

- 10 a process for multiplexing the reference frame identification information together with encoded moving picture data.